Digital literacy as a challenge for Teacher Education

Implications for educational frameworks and learning environments

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Abstract. Relationships between technological development and learning are described and the development of cultural tools and external memories are pointed out. The processes of how learning integrates with ICT are viewed from socio-cultural as well as constructionist theoretical perspectives. The concept of digital literacy is understood to be closely related to learning processes as social practices. Examples of how digital literacies can be introduced and performed in courses and educational programs within teacher education are given. Learning environments which can support development of digital literacies are presented with examples from Stockholm Institute of Education/Stockholm University.

1 Introduction

Technology transforms learning and the conditions for learning. The challenge to teacher education is to translate ICT into learning possibilities. The use of ICT has inspired a modernized literacy idea, digital literacy, which has become a collective concept for traditional literacies such as reading and writing as well as information and media literacy concepts. UNESCO defines literacy as the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning to enable an individual to achieve his or her goals, to develop his or her knowledge and potential and to participate fully in the wider society.

Digital literacy has become an important issue within the EU. The objective within EU is to support development of digital competencies as well as digital repositories to raise the level of knowledge and employment in European countries. The political dimension brings discussion, new research and new definitions of digital literacy concepts. Digital literacies are often understood as various kinds of

skills which can be learned in order to master technology. In this paper digital literacies are viewed from a socio-cultural viewpoint which highlights the interplay between technology and learning as social practice.

2 Technological developments and its relation to learning

What is involved in learning with technology and how may this have a bearing on how we understand digital literacies?

The relationships between learning and material culture (technologies) are pointed out by Säljö: "all human knowing is at some stage dependent on materiality and the coordination between minds, communication and artefacts; what we call learning changes over time and thus is a moving target" [1,2]. Through history we can see how minds and cognition, learning and knowledge have been shaped by which kinds of means of communication and resources were available. A key process in knowledge development is the development of cultural tools where our experiences and insights get externalised and in-scripted into material objects. Those externalisations are according to Säljö physical and intellectual at the same time. Cultural tools - from the making of images as rock paintings via book printing to digital technology - rely on materiality. Our intellectual artefacts, concepts, formulas, classification systems, social languages interplay with material artefacts such as instruments, documents, databases etc. These cultural tools will, due to what social and discursive qualities, assumptions and functions are embedded within them, influence our learning processes. [2,3]

In what way have learning processes changed with technological development? How do people and tool shape each other? We can view the functioning of technology as a black box. Tools/ machine are accepted as solid and its functions and processes are accepted without questioning (i.e. the example of the calculator. We can perform complex tasks even if we don't know the steps or the processes. Knowledge structures are inherent in technological systems and tools and we learn the procedure to get the relevant knowledge, rather than trying to understand the structure or system. The development of external memories and storage systems, books, libraries, databases and other archival systems means that the information storage issues are solved. Furthermore it has had massive implications for learning. There are now reliable, public, accessible repositories of data etc which can be used endlessly. [4,5]

Midoro has further clarified the characteristics of scripts as texts and multimedia and the potentials of digital technology. The hyper-mediality of digital documents gives further possibility to handle parts of documents which implies a new way of handling content [6].

Thus a lot of information and potential knowledge such as text, audiovisual etc is organized in external memory systems and can be retrieved and translated into new knowledge by someone who knows how [7] Knowing how, i.e. to search information in databases or work with a communication and learning platform involves meta-communication and meta-cognition of how to do a search or develop a model. This means that we now deal with concepts rather than hierarchal organized knowledge. Studies of information searching processes show how people develop new behaviour which is conceptually oriented rather than hierarchal organized [3,8].

Individual and mobile storage devices such as mobile phones, i-pods mean that we can retrieve and manipulate information from external systems and databases and communicate, produce and present new material instantly without physical boundaries.

2.1 Digital literacy – a matter of learning as social practice

The close relationship between technology and learning implies that digital literacy can be recognized as a "compound and complex concept that changes with the development of digital media"[9]. Digital literacies can be sorted into various dimensions, which can be useful when trying to set up programs for development of courses and educational programs. Information literacy can be described as the ability to collect, organize, evaluate information and form valid opinions on what is learned. Technology literacy can be described as the ability to use technology, use and access new media and the internet and communicate information. Media literacy is how to use new media in a creative way, produce, communicate and present contents to a wider audience. Global literacy is to understand the global complexity and interact and communicate accordingly. Literacy of responsibility is to consider social consequences and use and communicate information safely from privacy and other social issues. [10]

Our understanding of and the conditions for digital literacy have to do with how we build representations of knowledge into digital collective memory banks; how we master and communicate these representations, and how we reconvert them into new knowledge [2] Other fundamentals are the social contexts where we learn and use digital tools/environments individually or as part of a group or community. Focus should be on learning in practice rather than acquiring specific skills to master technology. Digital literacies are here understood as social practices closely related to the use of technology.

Socio-cultural perspectives on learning and knowledge originate from social constructivism and cultural history theories. Socio-cultural theory is often used to create frameworks of teacher education. To explain digital literacies as social practices the following aspects of socio-cultural theory are helpful: learning is situated; learning is social; learning is dependent on mediation and learning has to do with participation in communities of practice.

Learning is situated. This idea, which is well represented in many areas of research is that thinking as well as learning and production of knowledge is always embedded or situated in a context. This implies that learning as it normally occurs is a function of the activity, context and culture in which it happens. This contrasts with most classroom learning activities which involve knowledge which is abstract and out of context. The principles are that knowledge needs to be presented in an authentic context, i.e., settings and applications that would normally involve that knowledge. This implies that if we wish to design or understand the learning processes teacher education students engage in we have to comprehend the contexts or environments where they take place [11]

Learning is social. Social interaction plays a fundamental role in the development of cognition. Vygotsky claimed that cognitive activities/ learning always takes place on two levels: first, on the social level, and later, on the individual level; first,

between people and then inside the individual. This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals.[12]. Learning as a social phenomenon is understood by looking at the learner as situated in a context which he interrelates to. It involves our experience of participation. Learning thus requires social interaction and collaboration.

Learning can be interpreted as participation in communities of practice. A community according to Wenger is characterized by mutual engagement, joint enterprise and shared repertoires. The concept of practice has a connotation of doing but it is not just doing in itself. It is doing in a social context that constitutes social practice. The concept of practice includes both the practical and theoretical, ideals and reality, talking and doing [7]. Communities of practice have been a very useful concept in explaining learning within networked communities and the conditions for e-learning, and on-line learning, i.e. working with portfolios on a learning platform where shared ideas and behavior are vital elements.Learning is according to Wenger above all the ability to negotiate new meaning to earlier experience. [7]

3 Learning environments and educational frameworks

A challenge Teacher Education in Sweden has to face is how to reach the quantitative targets concerning proficiency and ability which is: "For teaching qualification the student will show ability to use ICT in teaching activities and realize the role of multimedia". Further more "During the time of education the student will continuously use ICT as a support for his/her studies". [13]

3.1 Learning environments

At Stockholm Institute of Education the ICT issue has to a large extent been managed with the help of the Learning Resource Centre (LRC), Lärum. The objectives are to provide tools and spaces for learning and teaching and develop the competencies of future teachers as well as having an initiating, coordinating, and developing role concerning ICT and its use in education and research.

The LRC is organized into three functional units: the University College Library with information services, user education and physical/virtual learning spaces; the Media Production department with a media laboratory with facilities for text, images, video production and services for computer- and video-conferencing; the Educational ICT-department with the task to build collaborative projects with teachers, students, school projects, support distance education and provide competence development. The staff includes professional librarians, media producers, ICT-teachers, technicians, web designer, and project managers from various disciplines. This means that different competencies can be taken into account in order to produce learning and teaching spaces and tools.

The LRC provides hybrid learning environments with digital systems and physical repositories such as the library collections and video-archives. Tools for analysis, production, mediating and presenting new knowledge are supplied such as the self-managed diagnostic web tool for basic ICT proficiency and the e-archive

where students' can write their thesis's. A guiding idea is that people learn best when they are participating in design or creative activities and that the learner should be given better opportunities to construct together with their peers. The library and the media laboratory with computer work areas are open, lively spaces for individual and group work social interaction and students' communication patterns.

To serve the purpose of exploring new working methods which can be used in schools the LRC together with three companies (Hewlett Packard, Luxo and Kinnarps) developed the Classroom of the Future. The latest technology can be used in a truly flexible hybrid environment such as tools to design learning objects, engage in games and robots.

In the socio-cultural perspective the artefact is central. Students' thinking is thought to be intimate connected to the artefacts they are using shown in the interaction between student and artefact where the student often can manage complicated actions without being able to verbalize them. Säljö means that it is useless trying to understand what goes on in one student's head – instead we try to understand learning in the interaction between students, teachers and artefacts. [1]

When learning is shaped by the social environment every person has a larger extent of potential for learning than the definite capacity of the individual when learning is facilitated just by someone with larger knowledge.[12] This range of a person's potential is called the zone of proximal development and is essential according to Vygotsky's ideas. Learning in the zone of proximal development is a combined activity in which the teacher simultaneously keeps an eye on the goals of course and on what the student with assistance is capable to do. [15] Scaffolding is a strategy that teachers use to move learning forward in the zone of proximal development. It is a collaborative process. It involves negotiation of meaning between the teacher and the student about expectations and how to improve the learning process in the best way. Examples of scaffolding are when the teacher provides the student with support such as e.g. hints encouragement, cognitive structures and reminders during the learning process through the course [16].

Due to this theoretical view of knowledge one of the main tasks of the LRC, is to provide students and teachers with learning environments in their actual work situations where they are able to learn in social interaction and a variety of artefacts. Another task is to create and support with relevant scaffolds so learning can take place in the zone of proximal development whether it is students or teachers who are the learners.

3.2 Educational frameworks

In order to improve the quality of students' scientific understanding and theoretical basis a general course was designed 2005 with the objectives to develop general abilities and competencies progressively throughout the teacher programme. The level 2 course objectives were to:
- Distinguish and use theoretical perspectives on human development and socialization, learning and education and special education issues
- Read and work with scientific texts
- Analyse texts and pedagogical case studies from different perspectives

Another goal was to develop and establish digital literacy competencies within the course work. A team of teachers and LRC staff described the abilities and literacies in the form of a general matrix. To get the students on the same proficiency level of digital literacy a self-managed diagnostic web tool for basic ICT proficiency was developed and introduced at the LRC.

The idea is that the development of digital literacies takes its starting point in the basic learning practices students engage in by using adequate tools/artefacts. The use of tools becomes an active part of the tasks and students' individual and group practices and repertoires. Learning is here seen as an individual and social process of experience, construction and negotiation with ICT artefacts in a context.

Communicative abilities	Manage and perform a group seminar on course content	Use digital work methods individually /group LMS blogs
	Present surveys and investigations	Advanced digital presentation, movie, audio, scanned pictures
Evaluative abilities	Assess owns own learning process reflection on meta learning	Use digital assessment tools i.e. portfolio in a Learning Management system
Ability to apply a scientific perspective on course contents	Distinguish between method, theory knowledge theoretical concepts	Use advanced search technology on internet, database searching source management, quality assessment

Table 1. [Examples of general base course]

3.2.1 A case study on teacher trainers

The issue of digital literacy for students has put special demands on teacher trainers. The LRC ICT teacher's task is to develop the competence of teacher educators. A teacher trainer should have the ability to:

- decide what kind of digital tools are appropriate for their course content and be able to present their course on line
- determine what kind of digital tools and work methods which support, develop or increase the quality of their course
- realize the affordances with different digital examinations so they can choose the best form of examination according to the aims and guideline
- clarify and highlight teaching and learning issues, for the students, according to chosen digital tools and methods

In June, 2007, the LRC ICT teachers met with a group of teacher trainers who wanted to increase the quality of their course by being tutored by the LRC. They performed a distance course during two semesters, the second year in the general

field of the teacher programme. The LRC team treated this as pilot-work which could be evaluated and further developed. Teacher trainers and the LRC team met 4 times to thoroughly go through the course objectives and the former assignments according to the objectives. The LRC team developed the course with new tools and new ways of using tools, which had positive consequences for the teachers' as well as the students' development of digital literacies (including communication competence). Another outcome was a revision of some of the assignments so that they got to be more firmly connected both to the course's objectives and the qualitative targets. Parts of the course were developed in software called Compendium, which is a mind mapping tool which enables you to provide hyperlinks between different parts of the diagram.

The course is still an ongoing project. A second group of teacher trainers were showed the documentation as a point of departure for transforming a campus course into a distance course. This second group was not as highly motivated as the original group, they had not planned for digital competence development and their digital literacy level was much lower. Nevertheless they felt highly motivated when they saw the structure and they understood the digital literacy target and its role in relation to the development of student abilities and towards the course objectives. The result was that the documentation of the first course content and digital components constituted a design support tool for creating new learning activities and a new understanding of digital competence according to course objectives and qualitative targets.

The success with the second teacher group occurred because the documentation served as a scaffolding artefact and highlighted how digital tools are related to a course context which was familiar to them, in accordance with the socio-cultural perspective. Another outcome was the importance of taking a point of departure in the content in order to get teacher trainers motivated. Another factor was the transparent progression of digital abilities aiming for digital competence both for students and teachers. As a transparent progression it served well as a planning tool for other learning activities as well as an evaluating tool. A result from the original course team was that they considered that the digital tools increased the course quality. When the students were supported by digital tools such as a web course on information literacy, they could exercise at home and were better prepared in class. The teachers could then start the next lesson on a higher level than before. When effectiveness of this kind becomes obvious to the teacher trainers they have no difficulties to find motivation.

4 Conclusions

To get a deeper understanding of what we mean by digital literacies it is fruitful to engage in a discussion of learning processes and technological development. Learning processes have been conditioned by technological development insofar that knowledge structures, culture and human experience get in-scripted into material objects. Digital artefacts or cultural tools with intellectual and technical/material resources can be mediated, distributed and used in ways which influence learning processes profoundly. We mean that learning should be viewed as social practices and that learning is dependent of context, social interaction and shared repertoires.

The implication of how we can comprehend digital literacy then is firstly that the concept changes with the development of digital technology and digital artefacts/media. Secondly , to develop digital literacies within educational programs the students' use of tools should be determined by and integrated in the learning practices directed towards the learning of course content and achieving of course objectives. To further inspire digital literacy development, learning environments should be designed with the complexity of learning processes and social nature in mind.   Scaffolding is proposed as an important tool for introduction of digital literacies.

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